Pearson BTEC Level 3 Nationals Certificate, Extended Certificate, Foundation Diploma, Diploma, Extended Diploma

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Learner Registration Number

Time 40 minutes

Paper reference **31617H/1B**

Applied Science/Forensic and Criminal Investigation

UNIT 1: Principles and Applications of Science I

Biology

SECTION A: STRUCTURES AND FUNCTIONS OF CELLS AND TISSUES

You must have:
A calculator and a ruler.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The exam comprises three papers worth 30 marks each.
  Section A: Structures and Functions of Cells and Tissues (Biology).
  Section B: Periodicity and Properties of Elements (Chemistry).
  Section C: Waves in Communication (Physics).
- The total mark for this exam is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 6 4 2 6 8 R A 0 1 1 2

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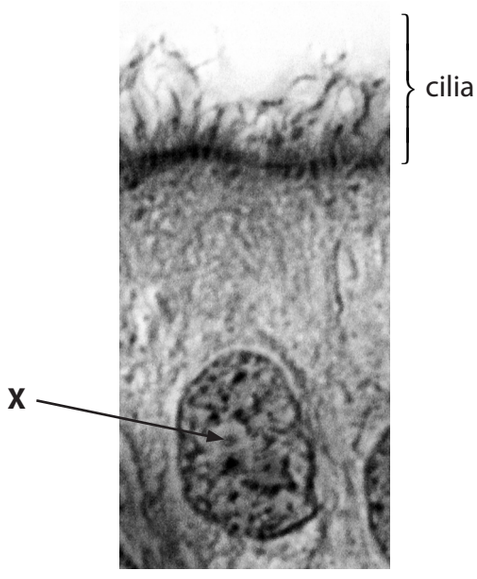
Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Figure 1 shows a photomicrograph of a ciliated epithelial cell.



(Source: © JOSE CALVO/SCIENCE PHOTO LIBRARY)

Figure 1

(a) Identify the cell component labelled **X** in Figure 1.

(1)

☒ **A** Golgi apparatus

☒ **B** Nucleus

☒ **C** Vacuole

☒ **D** Vesicle

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(b) The image of the cell shown in Figure 1 has an observed width of 4100 μm and has been magnified 500 times.

Calculate the actual width of the cell.

Show your working.

(2)

actual width = ... μm

(c) (i) Name **one** structure in the human body that is lined with ciliated epithelial cells.

(1)

.....

(ii) State the function of cilia.

(2)

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(Total for Question 1 = 6 marks)

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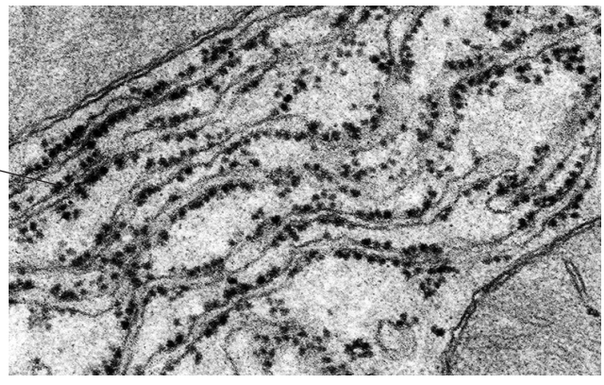
2 Figure 2 shows an electron micrograph of rough endoplasmic reticulum (RER).



(Source: © DENNIS KUNKEL MICROSCOPY/SCIENCE PHOTO LIBRARY)

Figure 2

(a) Identify the cell component labelled **Y** in Figure 2.

(1)

☒ **A** amyloplast

☒ **B** chloroplast

☒ **C** mitochondrion

☒ **D** ribosome

(b) After amino acids have been assembled into a protein, they enter the RER.

Some of these proteins leave the cell.

Identify the route the proteins take from the RER to the plasma membrane.

(1)

☒ **A** RER → Golgi apparatus → mitochondria → transport vesicles → plasma membrane

☒ **B** RER → lysosomes → transport vesicles → Golgi apparatus → plasma membrane

☒ **C** RER → transport vesicles → Golgi apparatus → mitochondria → plasma membrane

☒ **D** RER → transport vesicles → Golgi apparatus → transport vesicles → plasma membrane

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(c) The RER and the smooth endoplasmic reticulum (SER) have different functions.

State **two** functions of the SER.

(2)

1 .....

.....

2 .....

.....

(Total for Question 2 = 4 marks)

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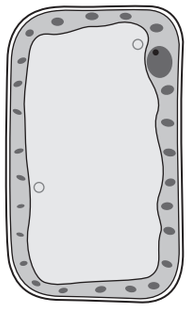
3 Plants contain specialised cells.

Figure 3 shows a diagram of a palisade cell.



(Source: © Photiconix/Alamy Stock Photo)

Figure 3

The surface area of the palisade cell is 989 μm^2.

The volume of the palisade cell is 1433 μm^3.

(a) Calculate the surface area to volume ratio of the palisade cell.

Use the equation: surface area to volume ratio = $\frac{\text{surface area}}{\text{volume}}$

Show your working.

(2)

surface area to volume ratio of the palisade cell = ...

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(b) Figure 4 shows a diagram of a root hair cell.

The root hair cell has a larger surface area to volume ratio than the palisade cell.

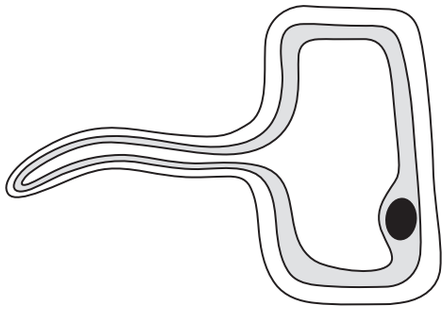

Figure 4

Explain how the larger surface area to volume ratio of the root hair cell supports its function.

(3)

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(Total for Question 3 = 5 marks)

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4 (a) Figure 5 is a flow diagram showing some of the stages of the sliding filament theory of muscle contraction.

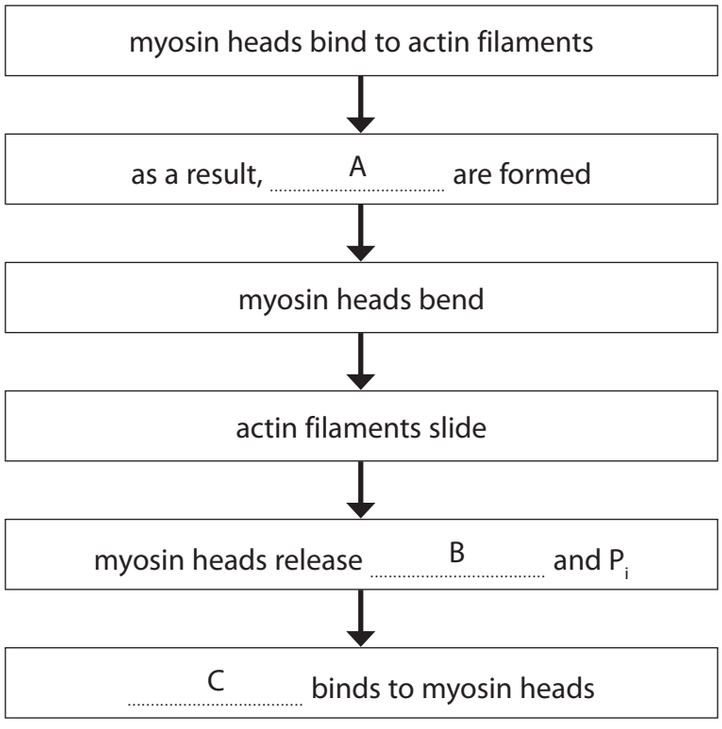
myosin heads bind to actin filaments
as a result, A are formed
myosin heads bend
actin filaments slide
myosin heads release B and P_i
C binds to myosin heads

Figure 5

Identify the missing words, A, B and C, in Figure 5.

(3)

A .....

B .....

C .....

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(b) Table 1 compares some of the features of fast twitch muscle fibres with the features of slow twitch muscle fibres.

feature	fast twitch muscle fibre	slow twitch muscle fibre
level of blood supply		
concentration of glycogen	High	Low
uses oxygen for respiration	No	Yes

Table 1

(i) Complete Table 1 to show the level of blood supply for fast and slow twitch muscle fibres.

(2)

(ii) Explain why fast twitch muscle fibres have a higher concentration of glycogen than slow twitch muscle fibres.

(4)

(Total for Question 4 = 9 marks)

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5 A nerve impulse is needed to trigger muscle contraction.

Action potentials are generated along neurones.

Figure 6 shows the membrane potential (mV) before, during and after an action potential in a neurone.

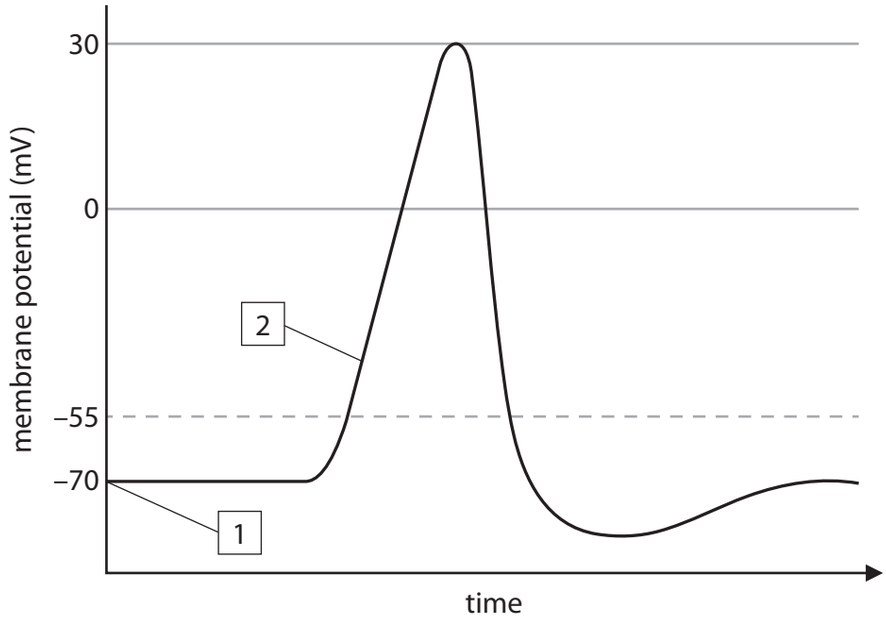

Figure 6

Explain the changes in membrane permeability and membrane potential between points 1 and 2 in Figure 6.

(6)

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(Total for Question 5 = 6 marks)

TOTAL MARKS FOR SECTION A = 30 MARKS

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